3. SEISMIC EVALUATION PERSONNEL

3.1 INTRODUCTION[1]

The purpose of this section is to define the responsibilities and recommended minimum requirements of the individuals who will implement the DOE Seismic Evaluation Procedure. The seismic evaluation personnel include individuals who develop the Seismic Equipment List (SEL), perform the facility walkdown and evaluate the seismic adequacy of equipment listed in the SEL, and perform the relay screening and evaluation. This may involve a number of safety, facility, and engineering disciplines including structural, mechanical, civil, electrical, systems, and seismic.

Most facilities may prefer to implement this procedure using a designated team of individuals; i.e., a Seismic Review Team (SRT). However, the functions and responsibilities may be assigned to existing departments or groups, without definition of a dedicated team, provided the individuals in these departments or groups have the appropriate qualifications and training and that the walkdown teams have the required collective qualifications. Similarly, the individuals who undertake the seismic review may be DOE staff; M&O contractor staff; and subcontractors, who are currently under contract to DOE or a M&O, provided the qualification and training criteria are met. This flexibility allows for the possibility that the functions may be performed by individuals of different disciplines at different times. DOE and M&O contractor staff are responsible for evaluating the qualifications of the seismic evaluation personnel for compliance with this procedure.

3.2 SEISMIC CAPABILITY ENGINEERS[2]

3.2.1 Responsibilities and Minimum Requirements

The Seismic Capability Engineers (SCEs) should:

- Become familiar with the seismic experience data approach as defined in the DOE Seismic Evaluation Procedure and EPRI / SQUG reference documents.
- Become familiar with the seismic design basis of the facility being evaluated, especially the equipment on the SEL and the Design Basis Earthquake (DBE) for the facility.
- Conduct the seismic evaluations and walkdowns of equipment and systems as described in the following chapters and sections:
  - Capacity versus Demand Evaluation (Chapter 5)
  - Anchorage Review (Chapter 6)
  - Seismic Interaction Evaluation (Chapter 7)
  - Equipment Class Evaluations Using Caveats for the Reference Spectrum and/or GERS (Chapter 8)
  - Equipment Class Evaluations Using Screening Procedures (Chapter 9)

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[1] Based on Section 2.0 of SQUG GIP (Ref. 1)
[2] Based on Section 2.4 of SQUG GIP (Ref. 1)

- Equipment Class Evaluations Using Screening Procedures or General Guidelines (Chapter 10)

- Relay Functionality Review (Chapter 11)

- Use the DOE Seismic Evaluation Procedure, along with experience and judgment, to evaluate the seismic adequacy of equipment and systems identified as necessary.

- Perform additional analyses and calculations, when necessary, to evaluate the seismic adequacy of the equipment and systems.

- Make recommendations for any additional evaluations or physical modifications to equipment or systems that may be necessary to determine the seismic adequacy of equipment identified as outliers as described in Chapter 12.

The SCEs may be assisted in fulfilling the above responsibilities by other individuals. For example, others may do background work to obtain information necessary for performing the seismic evaluations; they may also locate and assist in evaluating existing seismic qualification documentation; and they may perform backup calculations where necessary. Another example is that SCEs may ask the Systems Engineers, Safety Professionals, and the Operations Personnel for information on how an item of equipment operates in a system so they may decide whether a malfunction of certain features of the item of equipment will affect its safety performance. Regardless of what help the SCEs receive from others, they should remain fully responsible for all the seismic evaluations, engineering judgments, and documentation, including the details and backup documentation.

The recommended minimum requirements for the SCEs are:

- Bachelor of Science degree, or equivalent, in structural, mechanical, or civil engineering or related discipline,

- 5 years of experience in seismic design, testing, analysis, and/or evaluation of structures and equipment in DOE facilities and / or commercial nuclear power plants,

- Complete the 5-day DOE-developed training course on applying the EPRI / SQUG walkdown screening and seismic evaluation methodology for equipment at DOE facilities.

If an engineer has completed the 5-day EPRI training course on the EPRI / SQUG methodology for the commercial nuclear power industry, then the following list provides an alternative means of meeting the recommended minimum requirements for SCEs evaluating equipment at DOE facilities. The list replaces the recommended minimum requirement of attending the 5-day DOE-developed training course.

- Hold a certificate of completion for the 5-day EPRI course on the SQUG methodology presented for the commercial nuclear power industry,

- Complete the following supplemental DOE-specific training administrated under the oversight of the DOE: performance goals, capacity versus demand, and equipment classes beyond those covered in the EPRI course, as well as complete the associated case studies and quizzes. This supplemental training is conducted on a case-by-case basis depending on the qualifications of the engineer. It typically does not involve attendance of another training course.

The Screening Evaluation and Walkdown should be conducted by one or more SRTs consisting of at least two SCEs on each team. The engineers on each team should collectively possess the following knowledge and experience:

- Experience in seismic design, seismic analysis and test qualification practices at DOE facilities. This should include active mechanical and electrical equipment, process and control equipment, and safety equipment.

- Knowledge of the performance of equipment, systems, and structures during strong motion earthquakes in industrial process and power plants. This should include active mechanical and electrical equipment, process and control equipment, and safety equipment.

- DOE facility walkdown experience.

- Knowledge of DOE orders, standards, and guidance.

It is not necessary for each SCE to possess all of the above qualifications; differing levels of expertise among the SRT engineers is appropriate. However, each SRT should collectively possess the above qualifications and each engineer on the team should have the ability to make judgments regarding the seismic adequacy of equipment.

At least one of the SCEs on each of the SRTs should be a licensed Professional Engineer to ensure that there is a measure of accountability and personal responsibility in making the judgments called for in the DOE Seismic Evaluation Procedure.

In general, the individuals who perform the seismic review walkdown may be required to wear protective clothing, wear a respirator, work in radiation areas, climb ladders, move through crawl spaces, climb over obstacles, and work in high temperatures or other difficult situations. In addition to required facility-specific training, the SRT members should be in good physical condition and have the capability and willingness to perform these tasks as necessary.

3.2.2 Piping Evaluation Engineers

The Piping Evaluation Engineers are responsible for conducting the walkdown and screening verification of piping that is listed in the SEL. Recommended minimum requirements for the Piping Evaluation Engineers are:

- Satisfy recommended minimum requirements for SCEs,

- 5 years of experience in seismic design and / or evaluation of piping systems and support structures is desirable with the capability to apply sound engineering judgment based on the knowledge of the behavior of piping systems in actual earthquakes and seismic tests and to recognize potential failure modes,

- Complete the 1-day DOE-developed workshop, or equivalent, on applying the walkdown screening and seismic evaluation methodology for piping at DOE facilities.

3.3 OTHER SUPPORT PERSONNEL

There are several other groups of personnel who provide important assistance to the SCEs. These personnel include safety professional and systems engineers, operations personnel, and relay evaluation personnel. The combination of these personnel and the SCEs comprise a complete SRT.

3.3.1 Safety Professionals and Systems Engineers[3]

The primary responsibility of the Safety Professionals and Systems Engineers is to develop the SEL, as described in Chapter 4. This involves identifying the various types of safety equipment that exist within the facility and determining which types will be evaluated with the Screening Evaluation and Walkdown.

If the SEL contains few outliers following the facility walkdown, further evaluation by the Safety Professionals and Systems Engineers may not be necessary. However, if as a result of the walkdown, numerous outliers are found or outliers which are difficult to resolve are identified, the Safety Professionals and Systems Engineers may be requested to further evaluate the SEL.

In addition to the primary responsibility of developing the SEL, the Safety Professionals and Systems Engineers may be asked to provide background information and guidance to the SCEs who evaluate the seismic adequacy of the equipment and the Relay Evaluation Professionals who perform the relay functionality review.

The Safety Professionals and Systems Engineers should be degreed engineers, or equivalent, and have extensive experience with the broad understanding of the systems, equipment, and procedures of the DOE facility being evaluated.

3.3.2 Operations Personnel[4]

The Operations Personnel have two types of responsibilities during implementation of this procedure. First, they are responsible for reviewing the SEL (developed in Chapter 4) to confirm that the SEL is compatible with approved normal and emergency operating procedures for the facility. Second, Operations Personnel may be asked to assist the SCEs during the Screening Evaluation and Walkdown and assist the Relay Review Personnel during the Relay Functionality Review.

To fulfill these responsibilities, the Operations Personnel should have knowledge of both steady-state and transient operations and the associated facility-specific operating procedures. They should be able to supply information on the consequences of, and operator recovery from, functional anomalies. It is their responsibility to provide information on the function and operation of individual equipment, instrumentation, and control systems.

Operations Personnel may assist the SCEs either as staff support or as members of an SRT. Though it is not required that the Operations Personnel be part of the seismic walkdown team, it is recommended. The Operations Personnel should have experience in the specific facility being seismically evaluated.

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[3] Based on Section 2.2 of SQUG GIP (Ref. 1)
[4] Based on Section 2.3 of SQUG GIP (Ref. 1)

3.3.3 Relay Evaluation Personnel[5]

The Relay Evaluation Personnel include those individuals who will perform the Relay Functionality Review described in Chapter 11. This evaluation includes reviewing electrical circuit drawings, documenting the review conclusions, performing the relay walkdowns, and providing associated support activities.

Electrical engineering will be the primary engineering discipline involved in the relay review; however, the evaluation may also use a number of other engineering disciplines; including structural, mechanical, civil, systems, and earthquake engineering. Information and assistance from facility personnel regarding operations and maintenance may also be required. The capabilities and responsibilities of the various Relay Evaluation Personnel are listed below.

The Lead Relay Reviewer should be a degreed, or equivalent, electrical engineer with experience who is familiar with the Relay Functionality Review procedure described Chapter 11. The relay walkdown is not expected to involve entries into radiation areas nor any special physical demands. The Lead Relay Reviewer should either perform the review or assist reviewers in interpreting electrical design drawings and in identifying essential relays in the safety systems. The Lead Relay Reviewer should have a good understanding of circuit design logic and the consequences of relay malfunction in essential circuits.

Assistant Relay Reviewers with electrical engineering, or equivalent, backgrounds can be used to document the relay review and obtain support documentation such as electrical drawings, technical specifications, operator reference manuals, and procedures

Safety Professionals, Systems Engineers and Operations Personnel who are capable of providing information on the operation of the safety systems and facility operating procedures should be used in the Relay Functionality Review. Their assistance will be needed to identify equipment for the SEL and essential control and power circuits which may be tripped as a result of an earthquake. They should also be able to provide information on the instrumentation and controls available to monitor and control the equipment affected by relays. A staff electrical and/or instrumentation and controls maintenance representative should be available to provide assistance during the Relay Functionality Review to help establish the location, mounting, types and characteristics of relays in the safety circuits.

The SCEs should perform certain appropriate evaluations in support of the Relay Functionality Review. These evaluations can be performed during the Screening Evaluation and Walkdown and include:

- Identifying potential instances of seismic spatial interaction.
- Giving special consideration to expansion anchor bolts which secure cabinets containing essential relays.
- Establishing in-cabinet amplification factors for and lowest natural frequency of cabinets containing essential relays.

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[5] Based on Section 2.5 of SQUG GIP (Ref. 1)

3.4 TRAINING

A workshop and training course were developed by DOE to provide guidance on how to implement seismic evaluations using the DOE Seismic Evaluation Procedure and the referenced EPRI / SQUG documents.

DOE Workshop on Walkdown Field Guide and SQUG / EPRI Seismic Qualification Material (Reference 63) The workshop provides an overview of the methodology employed by the EPRI / SQUG seismic qualification material for seismic evaluations of equipment in existing DOE facilities. By attending the workshop, participants obtain copies of the EPRI / SQUG evaluation material for use at DOE facilities. The workshop is provided for DOE staff, M&O contractor staff, and subcontractors who were under contract to DOE or a M&O. In addition, the workshop had training on the use of the Walkthrough Field Guide which is discussed in Section 1.4.1. The intent of the Field Guide training is to introduce techniques for efficiently identifying and upgrading significant seismic concerns at DOE facilities.

DOE Training Course on SQUG / EPRI Walkdown Screening and Seismic Evaluation Material (Reference 64) The training course provides guidance for implementing and following the procedures of the DOE Seismic Evaluation Procedure. Detailed information about the Screening Evaluation and Walkdown Procedure, capacity versus demand evaluation, anchorage review, seismic interaction evaluation, electrical and mechanical equipment review, tanks and heat exchangers review, cable tray and conduit systems review, and relay functionality review is presented in the course. As part of the course, attendees complete a study guide and pre-test, complete quizzes, and participate in a walkdown. This course is provided primarily for the SCEs, however others who may support these engineers may also take this course. Attendance at the training course is currently a mandatory step for any DOE site to obtain the EPRI / SQUG documents and to permit use of the documents for safety-basis evaluations. Videotapes of the course are available through LLNL.

The objective of the DOE training course is as follows: (1) provide additional information on the background, philosophy, and general approach developed by the DOE to conduct seismic evaluations of DOE facilities and (2) provide additional guidance in the use of the DOE Seismic Evaluation Procedure and applicable references to select the SEL and to verify their seismic adequacy. Implementation of the procedures in the DOE Seismic Evaluation Procedure require experienced, well-trained engineers applying sound engineering judgment. As a result, the training course provides for the transfer of the necessary technology to DOE sites and the training of DOE and contractor personnel to conduct seismic evaluations.

A revised version of the training course in Reference 64 provides tailored training for DOE sites. This revised version emphasizes the DOE Seismic Evaluation Procedure and the aspects of the Procedure which are of most interest to DOE sites. In addition to the material discussed in Reference 64, the revised training covers DOE-specific classes of equipment, such as piping, HVAC ducts, and architectural features and components.

DOE Workshop on Qualification of Piping Systems (Reference 65) The workshop provides guidance for implementing and following the procedures of the DOE Seismic Evaluation Procedure for piping systems. Detailed information about the codes and standards for process, instrumentation, and fire protection piping systems; loading of piping systems; qualification by analysis; testing experience data; earthquake experience data; seismic screening criteria for piping and tubing; special considerations for buried piping; and special considerations for double-wall piping are presented at the workshop. As part of the workshop, attendees participate in discussions and are given an examination. This workshop is provided primarily for SCEs who are also Piping Evaluation Engineers, however others who may support these engineers should also take this course.